

Monitoring Riparian Birds at Ouray National Wildlife Refuge: 2012 Field Season Report



March 2013



ROCKY MOUNTAIN BIRD OBSERVATORY

Mission: *To conserve birds and their habitats*

Vision: *Native bird populations are sustained in healthy ecosystems*

Core Values: *(Our goals for achieving our mission)*

1. **Science** provides the foundation for effective bird conservation.
2. **Education** is critical to the success of bird conservation.
3. **Stewardship** of birds and their habitats is a shared responsibility.

RMBO accomplishes its mission by:

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Monitoring long-term trends in bird populations for our region.

Providing active, experiential, education programs that create an awareness and appreciation for birds.

Sharing the latest information in land management and bird conservation practices.

Developing voluntary, working partnerships with landowners to engage them in conservation.

Working across political and jurisdictional boundaries including, counties, states, regions, and national boundaries. Our conservation work emphasizes the Western United States, including the Great Plains, as well as Latin America.

Creating informed publics and building consensus for bird conservation needs.

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EXECUTIVE SUMMARY

In 2012, Rocky Mountain Bird Observatory, in cooperation with the U.S. Fish and Wildlife Service, implemented the fourth year of a project designed to monitor populations of riparian birds in eastern Utah. In total, 340 point counts were conducted at six transects along the Green River in eastern Utah. At Ouray National Wildlife Refuge, 220 point counts were conducted at three transects and on Bureau of Land Management lands 120 points counts were conducted at three transects. Ouray National Wildlife Refuge transects were surveyed five times during the course of the season and Bureau of Land Management transects four times each. All surveys were conducted between 9 May and 30 June. Rocky Mountain Bird Observatory also surveyed two transects five times each at Dinosaur National Monument along the Green and Yampa Rivers in Colorado in 2012 using the same protocol.

ACKNOWLEDGEMENTS

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INTRODUCTION

Riparian habitat comprises very little of the landscape in the western U.S.; however, many wildlife species depend on this habitat (Bureau of Land Management 1998). The Bureau of Land Management (BLM) estimated that the number of birds that depend upon riparian habitat in the western U.S. is two to ten times higher than all other available habitats (Bureau of Land Management 1998). One recent publication compiling information about riparian areas in the western U.S. has a very extensive list of current threats: dams, pollution (point and nonpoint), grazing, land use change, timber harvesting, water diversion, road construction, recreation, mining, groundwater pumping, invasive species, climate change, salinity, fire, insect and diseases, woody encroachment, watershed degradation, elimination of native vegetation, beavers, fire suppression, and fuel management (Poff et al. 2011). The introduction of exotic tree and shrub species has caused dramatic changes to riparian areas in the western U.S. Tamarisk (*Tamarix sp.*), a plant species intentionally introduced into western riparian areas to control erosion, has spread rapidly and displaced native species (Glenn and Nagler 2005). No insect species native to the U.S. forages on tamarisk. Other non-native plants, such as Russian olive (*Elaeagnus angustifolia*), Siberian elm (*Ulmus pumila*), and several species of knapweed (*Centaurea sp.*) have also invaded western riparian areas.

Because invasion of non-native species has negatively impacted stream flow, stream sedimentation, soil salinity, fire regimes, livestock forage, and regeneration of native vegetation, various methods have been employed to remove Tamarisk and other non-native plant species from riparian areas (Tamarisk Coalition, unpublished). These methods include mechanical removal, chemical treatment and, more recently, biological control. In 2001, the non-native Tamarisk Leaf Beetle (*Diorhabda sp.*) was released in the Upper Colorado River Basin in an effort to control Tamarisk. It is currently believed that the beetle eats only Tamarisk leaves throughout its life cycle.

Biologists have studied the relationship between birds and invasion of Tamarisk in riparian ecosystems of the Lower Colorado River Basin for several decades (e.g., Anderson et al. 1977). In the Lower Colorado River Basin, use or avoidance of Tamarisk by birds varied among avian species, river systems, and resident status (Hunter et al. 1988, Ellis 1995, Sogge et al. 2008, Van Riper et al. 2008). Avian species abundance in some areas peaked at intermediate levels of Tamarisk cover (Van Riper et al. 2008).

In contrast to the lower basin, little research has occurred on bird-Tamarisk relationships in the Upper Colorado River Basin. Furthermore, no published studies have investigated the effects of biological control of Tamarisk on birds. Rocky Mountain Bird Observatory (RMBO), in cooperation with The Tamarisk Coalition, initiated a study in 2009 to evaluate the effects on birds of Tamarisk defoliation by Tamarisk Leaf Beetles in riparian habitat. Our primary objective was to estimate densities of bird species and bird species richness as a function of Tamarisk cover and defoliation of Tamarisk.

METHODS

Study Area and Site Selection

The study area for surveys conducted in 2012 was confined to the Green River from just north of Canyonlands National Park to Ouray National Wildlife Refuge and one survey site was just north of (upstream from) Ouray National Wildlife Refuge. The area surveyed consisted of riparian vegetation along the Green River at locations originally chosen for surveys in 2009. We defined our sampling unit as a 5-km² block.

We used ArcMap (ESRI 2005) and Google Earth (Google, Inc. 2009) software, and a digital map of vegetation cover from the Southwest Regional Gap Analysis Project (SWREGAP; Lowry et al. 2005) to characterize the study area. Landcover types we used were Invasive Southwest Riparian Woodland and Shrubland, and Rocky Mountain Lower Montane Riparian Woodland and Shrubland (Ecological System codes D04 and S093, respectively; Lowry et al. 2005). We originally selected 44 sampling units by the following process:

1. Using ArcMap, overlaid a 5-km² grid on the Utah and Colorado portion of the Upper Colorado River Basin.
2. Retained only grid cells that contained at least 3.5 km of the Colorado River and/or one of its major tributaries.
3. Overlaid digital maps of native and invasive woody riparian vegetation from SWREGAP.
4. Retained only grid cells that contained native and/or invasive woody riparian vegetation.
5. Categorized each grid cell with respect to whether it was inside or outside of the range of the Tamarisk Beetle in 2008.
6. Randomly selected cells within and outside of the beetle range.
7. Overlaid a grid of potential sampling points (250 m spacing) within each grid cell.
8. Overlaid randomly selected cells and their associated points on satellite imagery in Google Earth.
9. Rejected any cell that contained < 8 points in woody riparian vegetation.
10. Rejected any cell that was inaccessible by automobile and foot.
11. For retained cells, rejected sampling points not occurring in woody riparian vegetation, or, sometimes, moved sampling points < 150 m to place them in riparian vegetation.
12. Selected the most contiguous 8-16 points within each cell for sampling.

Field Methods

Birds were surveyed from points using methods that allow for estimating detection probability through the principles of Distance sampling. Distance sampling theory estimates detection probability as a function of the distances between the observer and the bird detected (Buckland et al. 1993). The detection probability is used to adjust the count of birds to account for birds that were present but undetected.

We surveyed all transects in the morning between ½-hour before sunrise and 11 AM. We conducted six-minute point transects at stations located at 250-m intervals along each transect. We recorded all bird detections on standardized forms. We recorded flyovers (birds flying over, but not using the immediate surrounding landscape) but excluded them in analyses of density. For each bird detected, we recorded the species, sex, how it was detected (e.g., call, song, drumming), and horizontal distance from the observation point. Whenever possible, we measured distances using a laser rangefinder. When it was not possible to measure the distance to a bird, we often used rangefinders to gauge distance estimates by measuring to some nearby object.

We recorded atmospheric data (i.e., estimated temperature in degrees Fahrenheit, cloud cover, precipitation, and wind speed) and the time at the start and end of each transect. We measured distances between points using hand-held Global Positioning System (GPS) units. We used Universal Transverse Mercator (UTM) North American Datum 1983 for all GPS data.

We recorded vegetation data; including the primary habitat type, the habitat's structural stage, and the types, relative abundance, percent coverage, and mean height of trees, shrubs, and groundcover. If there was a distinct subcanopy present, we recorded the types of sub-canopy trees. We recorded these data prior to beginning each point count. After each point we used nets to "sweep" for beetles on tamarisk present around the point. If beetles were present, we counted and recorded the number of beetles. We also recorded the percent defoliation of Tamarisk.

Data Analysis

Application of distance theory requires that three critical assumptions be met: 1) all birds at and near the sampling location [distance = 0] are detected; 2) distances of birds are measured accurately; and 3) birds do not move in response to the observer's presence. Our sampling protocol met the assumptions of Distance sampling theory reasonably well (Hanni et al. 2009).

We used Program Distance 6.0 (Thomas et al. 2010) to estimate the detection probability and density of each bird species. We fit the following functions to the distribution of distances for each species: Half normal key function with cosine series expansion, Uniform function with cosine series expansion, Hazard rate key function with cosine series expansion, and Hazard rate key function with simple polynomial series expansion (Buckland et al. 2001). The required sample size for estimating a detection function is at least 60-80 independent detections. We used Akaike's Information Criterion (AIC) corrected for small sample size (AIC_c) and model selection theory to select the most parsimonious detection function for each species (Burnham and Anderson 2002).

RESULTS

We surveyed six transects (three at Ouray National Wildlife Refuge and three on BLM land) along the Green River in eastern Utah between 9 May and 30 June, 2012 (Table 1). We surveyed 100% of transects that were scheduled for this project in 2012.

Table 1. Transect number, land ownership, and date of each visit for transects conducted in 2012 along the Green River in eastern Utah, 2012.

Transect	Ownership	Stratum ¹	1st Visit	2nd Visit	3rd Visit	4th Visit	5th Visit
TA_GREI7	BLM	TA	9-May	30-May	13-Jun	26-Jun	-
TA_GREO15	USFWS	ON	10-May	23-May	6-Jun	18-Jun	28-Jun
TA_GREO14	USFWS	ON	11-May	24-May	11-Jun	18-Jun	29-Jun
TA_GREO3	USFWS	ON	12-May	25-May	12-Jun	24-Jun	30-Jun
TA_GREI6	BLM	TA	17-May	31-May	14-Jun	27-Jun	-
TA_GREO13	BLM	TA	22-May	5-Jun	17-Jun	25-Jun	-

¹Stratum=land ownership (ON=Ouray National Wildlife Refuge and TA=BLM)

Table 2 shows number of points conducted at each transect during each visit in 2012 and the total number of points conducted at each transect for the entire season.

Table 2. Number of points conducted at each transect for each visit along Green River in eastern Utah, 2012.

Transect	Stratum ¹	1st Visit	2nd Visit	3rd Visit	4th Visit	5th Visit	Total
TA_GREI7	TA	11	11	11	11	-	44
TA_GREO15	ON	15	15	15	15	15	75
TA_GREO14	ON	14	14	14	14	14	70
TA_GREO3	ON	15	15	15	15	15	75
TA_GREI6	TA	10	10	10	10	-	40
TA_GREO13	TA	9	9	9	9	-	36

¹Stratum=land ownership (ON=Ouray National Wildlife Refuge and TA=BLM)

We recorded 5,641 birds representing 114 species during surveys in 2012. Please note that 10-20% of the detections are truncated during analyses (therefore the total number of birds in appendix is less). We were able to report density estimates for 36 species at Ouray National Wildlife Refuge and for 36 species on BLM lands and a total of 41 species for all transects in 2012 (Appendix A).

Survey effort, or total number of point counts conducted, each year of riparian surveys in eastern Utah and western Colorado is listed in Table 3.

Table 3. Survey effort by year and stratum in eastern Utah and western Colorado, 2009-2012.

Year	Stratum	Number of Point Counts Conducted
2009	ON	27
2010	ON	94
2011	ON	25

2012	ON	220
2009	TA	312
2010	TA	615
2011	TA	0
2012	TA	120

¹Stratum=land ownership (ON=Ouray National Wildlife Refuge and TA= BLM, Uintah and Ouray Indian Reservation, Private Lands, and State Lands)

DISCUSSION

The original objective of this project was to determine the effects of tamarisk biological control on riparian bird species in the Upper Colorado River Basin. Determining population trends requires a long term commitment because we will not be able to detect increasing or decreasing trends without many years of data. The USFWS is to be commended for recognizing the need for monitoring wildlife as part of their effort to document the effects of biological control and land management techniques and for the need to make this a multi-year project.

It is possible using Program Distance to construct a common detection function across years, and obtain separate density estimates for each year. Therefore, with each year of additional data we will be able to obtain stratum-level density estimates for more species using common detection functions. In other words, the number of species we will be able to monitor will increase annually if this project continues. Also, greater survey effort will increase the number of species we will be able to monitor.

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Appendix

Densities of bird species detected during riparian bird surveys in eastern Utah and western Colorado, 2009-2012.

Common Name	Stratum ¹	Year	Density ²	CV ³	LCL	UCL	n ⁴	Stratum ¹	Year	Density	CV ³	LCL	UCL	n ⁴	Total
Canada Goose	ON	2009	4.8	0.53	1.5	9.3	4	TA	2009	5.1	0.71	1.1	11.7	28	32
	ON	2010	-	-	-	-	0	TA	2010	1.0	0.57	0.3	2.1	11	11
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
Spotted Sandpiper	ON	2012	10.6	0.48	2.6	18.4	23	TA	2012	3.6	0.78	0.2	8.7	2	25
	ON	2009	-	-	-	-	0	TA	2009	1.4	0.32	0.8	2.3	13	13
	ON	2010	0.4	0.98	0.0	1.0	1	TA	2010	1.7	0.31	0.9	2.6	33	34
Mourning Dove	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	0.6	0.43	0.3	1.0	4	TA	2012	0.8	0.80	0.0	1.9	2	6
	ON	2009	51.6	0.33	25.4	80.0	31	TA	2009	22.8	0.22	15.0	32.2	144	175
White-throated Swift	ON	2010	22.5	0.20	16.2	31.0	46	TA	2010	25.5	0.16	18.7	32.7	329	375
	ON	2011	18.3	0.54	3.7	34.0	9	TA	2011	-	-	-	-	-	-
	ON	2012	33.7	0.35	14.0	52.4	155	TA	2012	18.6	0.53	5.7	34.4	46	201
Northern Flicker	ON	2009	-	-	-	-	0	TA	2009	12.3	0.49	4.1	23.2	13	13
	ON	2010	-	-	-	-	0	TA	2010	2.3	0.72	0.4	5.6	4	4
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	0
Western Wood-Pewee	ON	2012	-	-	-	-	0	TA	2012	-	-	-	-	-	0
	ON	2009	-	-	-	-	0	TA	2009	5.1	0.38	2.4	8.8	21	21
	ON	2010	3.6	0.55	1.2	7.0	4	TA	2010	2.5	0.37	1.2	4.1	19	23
Say's Phoebe	ON	2011	3.1	0.86	0.0	8.2	1	TA	2011	-	-	-	-	-	-
	ON	2012	7.0	0.28	4.5	10.5	20	TA	2012	2.6	0.85	0.0	6.7	4	24
	ON	2009	10.9	0.24	7.2	15.7	4	TA	2009	6.1	0.49	2.2	11.5	25	29
Ash-throated Flycatcher	ON	2010	18.1	0.59	2.3	36.5	23	TA	2010	7.5	0.45	2.7	13.3	63	86
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	15.8	0.45	6.2	28.6	45	TA	2012	5.0	0.93	0.0	13.6	8	53
Spotted Sandpiper	ON	2009	-	-	-	-	0	TA	2009	3.1	0.25	1.9	4.5	29	29
	ON	2010	-	-	-	-	0	TA	2010	1.4	0.31	0.8	2.2	24	24
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
Mourning Dove	ON	2012	0.2	0.81	0.0	0.4	1	TA	2012	3.1	0.53	0.6	5.8	9	10
	ON	2009	4.6	0.69	0.0	9.5	3	TA	2009	14.5	0.18	10.6	19.2	100	103
	ON	2010	2.0	0.54	0.7	4.0	4	TA	2010	12.5	0.24	8.3	18.2	166	170

Common Name	Stratum ¹	Year	Density ²	CV ³	LCL	UCL	n ⁴	Stratum ¹	Year	Density	CV ³	LCL	UCL	n ⁴	Total
Western Kingbird	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	3.0	0.21	2.2	4.2	15	TA	2012	12.0	0.20	8.4	16.3	32	47
	ON	2009	4.4	0.82	0.0	10.6	1	TA	2009	9.7	0.29	5.6	14.6	25	26
	ON	2010	3.6	0.42	1.2	6.0	3	TA	2010	13.3	0.28	7.5	19.5	58	61
	ON	2011	9.4	0.40	3.8	15.0	2	TA	2011	-	-	-	-	-	-
Plumbeous Vireo	ON	2012	2.7	0.46	0.9	4.8	5	TA	2012	10.8	0.47	3.1	19.5	12	17
	ON	2009	55.0	0.30	29.6	82.1	14	TA	2009	10.6	0.30	5.8	16.2	30	44
	ON	2010	31.8	0.32	14.7	47.5	30	TA	2010	11.4	0.24	7.3	16.4	66	96
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	27.8	0.51	8.3	56.3	55	TA	2012	13.0	0.79	0.7	30.7	14	69
Warbling Vireo	ON	2009	-	-	-	-	0	TA	2009	1.4	0.49	0.4	2.6	7	7
	ON	2010	-	-	-	-	0	TA	2010	2.0	0.36	1.0	3.3	20	20
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	0.9	0.45	0.3	1.4	3	TA	2012	0.0	0.00	0.0	0.0	0	3
	ON	2009	3.4	0.49	1.0	6.4	2	TA	2009	4.6	0.49	1.8	8.8	33	35
Black-billed Magpie	ON	2010	4.3	0.42	1.5	7.6	13	TA	2010	4.0	0.31	2.3	6.3	62	75
	ON	2011	5.4	0.38	2.6	8.8	4	TA	2011	-	-	-	-	-	-
	ON	2012	8.2	0.45	3.3	14.8	48	TA	2012	4.8	0.84	0.0	12.4	10	58
	ON	2009	-	-	-	-	0	TA	2009	1.6	0.19	1.1	2.2	16	16
	ON	2010	0.2	0.12	0.2	0.3	1	TA	2010	1.7	0.15	1.4	2.2	36	37
Common Raven	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	0.8	0.20	0.6	1.2	6	TA	2012	0.4	0.12	0.3	0.5	2	8
	ON	2009	-	-	-	-	0	TA	2009	8.4	0.26	4.9	12.1	19	19
	ON	2010	8.9	0.84	0.0	21.9	2	TA	2010	17.4	0.44	6.1	31.4	36	38
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
Violet-green Swallow	ON	2012	0.6	0.84	0.0	1.5	1	TA	2012	34.7	0.64	3.5	69.2	15	16
	ON	2009	26.0	0.91	0.0	70.6	2	TA	2009	53.2	0.73	10.4	130.8	22	24
	ON	2010	46.7	0.85	0.0	118.7	5	TA	2010	33.3	0.69	10.2	78.7	44	49
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	109.8	0.69	14.0	242.3	45	TA	2012	3.5	0.90	0.0	9.1	2	47
Cliff Swallow	ON	2009	37.4	0.27	22.2	55.9	4	TA	2009	4.7	0.68	0.6	10.7	8	12
	ON	2010	14.8	0.47	5.2	27.5	9	TA	2010	6.8	0.60	1.6	14.5	27	36
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	43.9	0.22	26.4	60.0	61	TA	2012	11.7	0.92	0.0	32.2	8	69
	ON	2009	-	-	-	-	0	TA	2009	0.9	0.29	0.5	1.4	10	10
Black-capped Chickadee	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	109.8	0.69	14.0	242.3	45	TA	2012	3.5	0.90	0.0	9.1	2	47
	ON	2009	37.4	0.27	22.2	55.9	4	TA	2009	4.7	0.68	0.6	10.7	8	12
	ON	2010	14.8	0.47	5.2	27.5	9	TA	2010	6.8	0.60	1.6	14.5	27	36
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
Rock Wren	ON	2012	43.9	0.22	26.4	60.0	61	TA	2012	11.7	0.92	0.0	32.2	8	69
	ON	2009	-	-	-	-	0	TA	2009	0.9	0.29	0.5	1.4	10	10

Common Name	Stratum ¹	Year	Density ²	CV ³	LCL	UCL	n ⁴	Stratum ¹	Year	Density	CV ³	LCL	UCL	n ⁴	Total
House Wren	ON	2010	-	-	-	-	0	TA	2010	0.5	0.38	0.2	0.9	11	11
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	-	-	-	-	0	TA	2012	0.5	0.37	0.2	0.7	2	2
	ON	2009	54.8	0.21	39.7	77.1	15	TA	2009	14.3	0.49	4.7	26.8	46	61
Blue-gray Gnatcatcher	ON	2010	19.3	0.41	7.3	30.7	19	TA	2010	9.9	0.43	3.3	17.6	65	84
	ON	2011	3.5	0.78	0.0	7.8	1	TA	2011	-	-	-	-	-	-
	ON	2012	56.7	0.27	32.6	84.9	123	TA	2012	31.2	0.87	0.0	74.7	37	160
	ON	2009	259.0	0.26	149.4	370.5	17	TA	2009	144.7	0.19	105.0	191.0	103	120
Mountain Bluebird	ON	2010	21.2	0.41	8.6	35.4	5	TA	2010	111.6	0.15	84.3	140.0	164	169
	ON	2011	-	-	-	-	0	TA	-	-	-	-	-	-	-
	ON	2012	64.1	0.49	21.2	114.7	29	TA	2012	208.9	0.18	154.7	277.2	59	88
	ON	2009	4.0	0.79	0.0	8.4	1	TA	2009	-	-	-	-	-	-
American Robin	ON	2010	-	-	-	-	0	TA	2010	0.6	0.46	0.2	1.0	6	6
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	3.4	0.81	0.0	6.9	6	TA	2012	-	-	-	-	-	-
	ON	2009	22.4	0.36	10.4	35.5	10	TA	2009	15.8	0.28	9.4	23.7	78	88
Northern Mockingbird	ON	2010	42.6	0.22	27.0	58.4	67	TA	2010	12.3	0.32	6.9	19.7	126	193
	ON	2011	59.5	0.14	46.4	74.2	24	TA	2011	-	-	-	-	-	-
	ON	2012	53.5	0.32	28.9	83.2	185	TA	2012	23.8	0.88	0.0	60.2	43	228
	ON	2009	-	-	-	-	0	TA	2009	2.8	0.56	0.9	6.0	37	37
European Starling	ON	2010	-	-	-	-	0	TA	2010	3.2	0.51	0.9	6.0	85	85
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	-	-	-	-	0	TA	2012	3.1	0.87	0.0	8.3	16	16
	ON	2009	63.8	0.49	20.0	120.3	7	TA	2009	10.0	0.49	3.4	18.8	20	27
Yellow Warbler	ON	2010	36.0	0.36	15.4	55.7	20	TA	2010	8.2	0.58	0.6	16.2	37	57
	ON	2011	17.0	0.86	0.0	43.7	3	TA	2011	-	-	-	-	-	-
	ON	2012	14.8	0.44	5.0	25.6	25	TA	2012	5.5	0.90	0.0	13.8	5	30
	ON	2009	321.1	0.27	195.7	452.1	44	TA	2009	65.7	0.16	49.4	83.1	112	156
Yellow-breasted Chat	ON	2010	273.5	0.22	177.0	360.7	140	TA	2010	72.8	0.14	55.8	91.6	244	384
	ON	2011	272.7	0.10	229.9	319.5	36	TA	2011	-	-	-	-	-	36
	ON	2012	414.0	0.24	277.7	572.4	483	TA	2012	113.5	0.62	25.2	218.4	73	556
	ON	2009	48.7	0.11	40.6	58.0	25	TA	2009	54.6	0.17	40.7	69.4	321	346
	ON	2010	38.4	0.18	29.5	50.7	68	TA	2010	51.5	0.18	38.2	66.8	595	663
	ON	2011	41.8	0.17	30.4	52.4	20	TA	2011	-	-	-	-	-	-
	ON	2012	29.1	0.17	21.6	37.0	121	TA	2012	78.1	0.30	44.2	114.2	180	301

Common Name	Stratum ¹	Year	Density ²	CV ³	LCL	UCL	n ⁴	Stratum ¹	Year	Density	CV ³	LCL	UCL	n ⁴	Total
Spotted Towhee	ON	2009	71.4	0.25	29.6	97.3	22	TA	2009	53.3	0.16	39.1	67.8	181	203
	ON	2010	57.1	0.31	28.3	81.4	61	TA	2010	59.5	0.12	48.1	71.1	404	465
	ON	2011	98.6	0.50	22.6	175.4	28	TA	2011	-	-	-	-	-	-
	ON	2012	135.2	0.14	103.4	166.6	211	TA	2012	77.4	0.10	65.9	91.0	101	312
Chipping Sparrow	ON	2009	-	-	-	-	0	TA	2009	-	-	-	-	-	-
	ON	2010	-	-	-	-	0	TA	2010	0.5	0.77	0.0	1.2	3	3
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	0.9	0.79	0.0	1.7	2	TA	2012	0.8	0.81	0.0	1.9	1	3
Brewer's Sparrow	ON	2009	-	-	-	-	0	TA	2009	0.2	1.09	0.0	0.7	1	1
	ON	2010	-	-	-	-	0	TA	2010	0.5	0.77	0.0	1.1	2	2
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	-	-	-	-	0	TA	2012	2.2	0.51	0.6	3.9	4	4
Vesper Sparrow	ON	2009	-	-	-	-	0	TA	2009	0.2	1.00	0.0	0.5	1	1
	ON	2010	-	-	-	-	0	TA	2010	0.7	0.87	0.0	1.6	8	8
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	-	-	-	-	0	TA	2012	0.0	0.00	0.0	0.0	0	0
Lark Sparrow	ON	2009	-	-	-	-	0	TA	2009	7.9	0.46	2.6	14.6	29	29
	ON	2010	3.2	0.57	0.6	6.3	3	TA	2010	3.2	0.35	1.5	5.2	24	27
	ON	2011	9.1	0.43	3.2	14.7	3	TA	2011	-	-	-	-	-	-
	ON	2012	5.9	0.46	2.0	9.7	16	TA	2012	2.5	0.60	0.2	4.8	3	19
Song Sparrow	ON	2009	5.2	0.97	0.0	14.2	1	TA	2009	11.4	0.38	5.3	19.3	26	27
	ON	2010	2.9	0.85	0.0	7.2	2	TA	2010	10.6	0.43	3.6	18.7	50	52
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	22.8	0.87	0.5	55.7	35	TA	2012	0.0	0.00	0.0	0.0	0	35
Black-headed Grosbeak	ON	2009	17.0	0.41	7.4	29.0	9	TA	2009	19.8	0.23	12.7	27.7	119	128
	ON	2010	20.5	0.25	12.3	29.1	38	TA	2010	17.1	0.23	11.2	23.6	197	235
	ON	2011	9.2	0.69	1.4	21.0	4	TA	2011	-	-	-	-	-	-
	ON	2012	17.5	0.24	11.7	25.4	73	TA	2012	25.4	0.16	19.2	32.0	58	131
Blue Grosbeak	ON	2009	5.5	0.82	0.0	13.8	2	TA	2009	16.3	0.26	10.2	24.3	65	67
	ON	2010	9.0	0.54	2.9	18.3	11	TA	2010	15.2	0.29	9.2	23.6	119	130
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
	ON	2012	0.7	0.85	0.0	1.9	2	TA	2012	20.8	0.46	7.8	36.1	31	33
Lazuli Bunting	ON	2009	27.6	0.78	0.0	59.9	7	TA	2009	23.2	0.30	12.5	35.3	65	72
	ON	2010	16.2	0.19	11.6	21.3	14	TA	2010	31.9	0.17	22.8	40.9	175	189
	ON	2011	8.4	0.71	0.0	16.7	1	TA	2011	-	-	-	-	-	-

Common Name	Stratum ¹	Year	Density ²	CV ³	LCL	UCL	n ⁴	Stratum ¹	Year	Density	CV ³	LCL	UCL	n ⁴	Total
Red-winged Blackbird	ON	2012	13.9	0.38	6.8	21.1	27	TA	2012	47.6	0.40	20.5	75.8	50	77
	ON	2009	31.4	0.51	9.2	60.2	7	TA	2009	39.6	0.50	13.3	76.4	52	59
	ON	2010	30.0	0.59	4.4	58.9	19	TA	2010	11.2	0.57	2.3	22.6	56	75
	ON	2011	40.3	0.50	9.8	72.8	9	TA	2011	-	-	-	-	-	-
Western Meadowlark	ON	2012	13.2	0.55	2.7	25.8	22	TA	2012	2.0	0.46	0.7	3.6	2	24
	ON	2009	1.6	0.46	0.3	2.7	2	TA	2009	4.0	0.51	1.0	7.7	57	59
	ON	2010	-	-	-	-	0	TA	2010	3.8	0.44	0.9	6.5	106	106
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
Brown-headed Cowbird	ON	2012	0.5	0.87	0.0	1.2	5	TA	2012	0.8	0.94	0.0	2.0	4	9
	ON	2009	121.1	0.26	71.2	173.7	19	TA	2009	57.6	0.26	34.8	83.3	101	120
	ON	2010	50.7	0.15	38.1	63.5	29	TA	2010	45.9	0.20	31.7	61.1	165	194
	ON	2011	42.1	0.38	18.2	64.8	8	TA	2011	-	-	-	-	-	-
Bullock's Oriole	ON	2012	68.9	0.23	43.1	94.6	93	TA	2012	24.6	0.55	6.0	47.9	21	114
	ON	2009	37.0	0.40	19.4	60.8	7	TA	2009	17.3	0.28	10.7	25.1	47	54
	ON	2010	2.2	0.35	1.1	3.3	2	TA	2010	5.6	0.28	3.2	8.2	28	30
	ON	2011	8.9	0.85	0.0	21.4	2	TA	2011	-	-	-	-	-	-
House Finch	ON	2012	12.9	0.27	6.7	18.4	27	TA	2012	13.1	0.43	5.8	21.6	15	42
	ON	2009	-	-	-	-	0	TA	2009	15.3	0.37	8.0	25.8	42	42
	ON	2010	-	-	-	-	0	TA	2010	2.7	0.40	1.2	4.7	16	16
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
Lesser Goldfinch	ON	2012	1.8	0.27	1.1	2.7	4	TA	2012	38.9	0.47	14.0	71.6	36	40
	ON	2009	-	-	-	-	0	TA	2009	913.9	31.47	1.0	8.9	6	6
	ON	2010	-	-	-	-	0	TA	2010	4.8	0.50	1.5	9.1	14	14
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
American Goldfinch	ON	2012	2.7	0.50	1.0	4.8	3	TA	2012	3.2	0.42	1.4	5.1	2	5
	ON	2009	98.6	0.69	11.3	223.2	7	TA	2009	40.5	0.48	15.3	77.3	36	43
	ON	2010	7.7	0.57	1.9	15.5	3	TA	2010	15.2	0.30	8.7	23.7	38	41
	ON	2011	-	-	-	-	0	TA	2011	-	-	-	-	-	-
Stratum=		2012	76.0	0.40	34.3	130.8	65	TA	2012	19.1	0.89	0.0	51.1	10	75

¹Stratum=survey location or land ownership. ON=Ouray National Wildlife Refuge and TA=BLM in 2012. In 2009-2010, TA=BLM, Uintah and Ouray Indian Reservation, Private Lands, and State Lands

²Density=Birds per km²

³CV is shown as number (i.e., 0.50=50%)

⁴n=number of observations used to calculate density. Typically, 10%-20% of total number of observations are truncated during analyses

